



Designation: **C387/C387M—17** **C387/C387M – 23**

Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar¹

This standard is issued under the fixed designation C387/C387M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope*

1.1 This specification covers the production, properties, packaging, and testing of packaged, dry, combined materials for concrete and high strength mortar. The classifications of concrete and mortar covered are defined in Section 3.

NOTE 1—The scope of this standard does not cover mortars for unit masonry. Dry preblended mortars for unit masonry are covered by Specification [C1714/C1714M](#).

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. Some values have only SI units because the inch-pound equivalents are not used in practice.

1.3 The text of this standard refers to notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of this standard.

1.4 The following safety hazards caveat pertains only to the test method portion of this specification. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

[C33/C33M](#) Specification for Concrete Aggregates

[C39/C39M](#) Test Method for Compressive Strength of Cylindrical Concrete Specimens

[C91/C91M](#) Specification for Masonry Cement

[C109/C109M](#) Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens)

¹ This specification is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.43 on Packaged Dry Combined Materials.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard



- C125 Terminology Relating to Concrete and Concrete Aggregates
- C138/C138M Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
- C143/C143M Test Method for Slump of Hydraulic-Cement Concrete
- C144 Specification for Aggregate for Masonry Mortar
- ~~E150~~C150/C150M Specification for Portland Cement
- C173/C173M Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
- C185 Test Method for Air Content of Hydraulic Cement Mortar
- C192/C192M Practice for Making and Curing Concrete Test Specimens in the Laboratory
- C207 Specification for Hydrated Lime for Masonry Purposes
- ~~E234~~C231/C231M Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
- ~~E260~~C260/C260M Specification for Air-Entraining Admixtures for Concrete
- C270 Specification for Mortar for Unit Masonry
- C305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency
- ~~E330~~C330/C330M Specification for Lightweight Aggregates for Structural Concrete
- C494/C494M Specification for Chemical Admixtures for Concrete
- C566 Test Method for Total Evaporable Moisture Content of Aggregate by Drying
- ~~E595~~C595/C595M Specification for Blended Hydraulic Cements
- C618 Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- ~~E702~~C702/C702M Practice for Reducing Samples of Aggregate to Testing Size
- ~~E989~~C989/C989M Specification for Slag Cement for Use in Concrete and Mortars
- ~~E116~~C1116/C1116M Specification for Fiber-Reinforced Concrete
- ~~E157~~C1157/C1157M Performance Specification for Hydraulic Cement
- C1240 Specification for Silica Fume Used in Cementitious Mixtures
- ~~E1329~~C1329/C1329M Specification for Mortar Cement
- C1437 Test Method for Flow of Hydraulic Cement Mortar
- C1438 Specification for Latex and Powder Polymer Modifiers for use in Hydraulic Cement Concrete and Mortar
- C1600/C1600M Specification for Rapid Hardening Hydraulic Cement
- C1714/C1714M Specification for Preblended Dry Mortar Mix for Unit Masonry

3. Terminology

3.1 Definitions—

3.1.1 For definitions of terms used in this specification, refer to Terminology C125.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *concrete, high-early strength, n*—in packaged, dry, combined materials, a product for building and repair requiring a more rapid than normal strength development.

3.2.1.1 Discussion—

This product allows for earlier removal of forms and allows concrete projects to be put into service much sooner than with normal strength concrete.

3.2.2 *concrete, normal strength, n*—in packaged, dry, combined materials, a product for general building and repair where thickness exceeds 50 mm [2 in.].

3.2.2.1 Discussion—

Typical uses include building or repairing sidewalks, patios, steps, footings, and for setting posts.

3.2.3 *concrete, normal strength, lightweight, n*—in packaged, dry, combined materials, a concrete product for building and repair where the lightest concrete density is desirable.

3.2.3.1 Discussion—

These mixtures will produce concrete that is about 25 % to 35 % lower in density than normal weight concrete.

3.2.4 *concrete, normal strength, lightweight using normal weight sand, n*—in packaged, dry, combined materials, a concrete product for building and repair where a lower density is desirable.

3.2.4.1 Discussion—

These mixtures will produce concrete that is about 15 % to 25 % lower in density than normal weight concrete.

3.2.5 *mortar, high-strength, n*—in packaged, dry, combined materials, a product for building or repair requiring a thickness of less than 50 mm [2 in.], or where a high strength mortar mixture is required.

3.2.5.1 *Discussion*—

Typical uses include topping and patching existing concrete structures. Often referred to as “sand mix.”

4. Ordering Information

4.1 The purchaser shall specify the material desired as concrete or high strength mortar and the respective physical requirements as specified in **Table 1** shall govern.

5. Materials

5.1 Materials used as ingredients in packaged, dry, combined materials for mortar and concrete shall conform to at least one of the following requirements:

- 5.1.1 *Aggregates*, shall conform to Specification ~~C33~~C33/C33M, Specification ~~C144~~, or Specification ~~C330~~C330/C330M.
- 5.1.2 *Air-Entraining Admixtures*, shall conform to Specification ~~C260~~C260/C260M.
- 5.1.3 *Blended Cement*, shall conform to Specification ~~C595~~C595/C595M or Performance Specification ~~C1157~~C1157/C1157M.
- 5.1.4 *Chemical Admixtures*, shall conform to Specification ~~C494~~C494M.
- 5.1.5 *Fly ash and natural pozzolans*, shall conform to Specification ~~C618~~.
- 5.1.6 *Slag Cement*, shall conform to Specification ~~C989~~C989/C989M.
- 5.1.7 *Hydrated Lime*, shall conform to Type S or Type SA of Specification ~~C207~~.
- 5.1.8 *Latex and Powder Polymer Modifiers*, shall conform to Specification ~~C1438~~.

NOTE 2—Type II latex polymers should not be used in applications that may be more than superficially wet in service.

- 5.1.9 *Masonry Cement*, shall conform to Specification ~~C91~~C91/C91M.
- 5.1.10 *Mortar Cement*, shall comply with ~~C1329~~C1329/C1329M.
- 5.1.11 *Portland Cement*, shall conform to Type I, IA, II, IIA, III or IIIA of Specification ~~C150~~C150/C150M.
- 5.1.12 *Silica Fume*, shall conform to Specification ~~C1240~~.
- 5.1.13 *Fibers*, shall conform to the applicable portions of Specification ~~C1116~~C1116/C1116M.
- 5.1.14 *Rapid hardening hydraulic cement*, shall comply with Specification ~~C1600~~C1600/C1600M.

TABLE 1 Physical Requirements

Kind of Material	Compressive Strength, MPa [psi] min		
	3 days	7 days	28 days
<i>Concrete:</i>			
High-early strength	17.0 [2500]	24.0 [3500]	...
Normal strength:			
Normal weight	...	17.0 [2500]	24.0 [3500]
Lightweight using normal weight sand ^A	...	17.0 [2500]	24.0 [3500]
Lightweight	...	17.0 [2500]	24.0 [3500]
<i>Mortar:</i>			
High-strength mortar		20.0 [3000]	35.0 [5000]

^A Lightweight concrete using normal weight sand may contain some portion of lightweight fines.



6. Preparation of Aggregate

6.1 All aggregates prepared in the laboratory for the purpose of establishing the correct proportions for the product shall be dried, without disintegration, to a moisture content of less than 0.1 % by mass. Verify moisture content using a ventilated oven in accordance with Test Method C566.

7. Proportioning

7.1 The proportions of cementitious material and aggregate shall be such that the strength requirements will be met when an amount of mixing water is used that produces for concrete the slump specified in 15.3 and for mortar the flow specified in 17.2.

8. Sampling

8.1 A lot for the purposes of weight uniformity is defined as the quantity of packaged material normally placed on a pallet. In general, this quantity will weigh from 900 kg to 1800 kg [2000 lb to 4000 lb].

8.2 A unit sample is a single package of material randomly selected from the lot.

9. Physical Properties

9.1 Packaged, dry, combined materials for concrete and high strength mortar shall conform to the respective physical requirements as given in Table 1 for the material specified when the prescribed amount of water is added.

10. Packaging and Package Marking

10.1 All packages shall be identified as conforming to Specification C387, and as to kind and type of material listed in Table 1 and the net mass in each bag printed thereon.

10.2 The yield in liters [cubic feet], and the amount of water recommended for mixing shall be marked on the package.

NOTE 3—The amount of water recommended should be the amount required to produce a slump of 50 to 75 mm [2 in. to 3 in.] for concrete and a flow of 110 ± 5 % for high strength mortar.

10.3 *Container Construction*—The strength of the container shall be adequate for the mass of concrete or mortar it is intended to contain.

10.4 The net weight in each container. The contents of any container shall not vary by more than 2% from the net weight stated in the markings. The average net weight of filled containers in a lot shall be not less than the weight stated in the markings.

11. Rejection

11.1 The purchaser has the right to reject material that fails to conform to the requirements of this specification. Rejection shall be reported to the Producer or supplier promptly and in writing.

11.2 The purchaser has the right to reject product in damaged or dampened containers.

12. Storage

12.1 Product must be stored in a dry area and shall not be stored in direct contact with the ground or floor.

SAMPLING AND TESTING



13. Accuracy of Measurement

13.1 Use scales conforming to the applicable sections of *Handbook 44*.³ New and reconditioned scales shall be accurate to $\pm 0.1\%$ of the total capacity of the scale. When scales have been in use, they shall be accurate to $\pm 0.4\%$ of the total capacity of the scale.

13.2 Record the mass of concrete in kilograms (pounds) to a minimum accuracy of 0.05 kg [0.1 lb.]. Record the mass of mortar in grams to an accuracy of within 1 g or 0.1 %, whichever is greater.

14. Sampling Concrete

14.1 Use a sufficient quantity of whole packages to conduct all testing from a single batch.

15. Mixing and Testing Concrete

15.1 Determine the net mass of concrete in the package (or packages), then empty into a clean, watertight container.

15.2 Mix the concrete, determine the properties of the fresh concrete, and mold and cure the specimens in accordance with the applicable provisions of Practice C192/C192M, or modifications of them as outlined herein. Test the strength of the concrete in accordance with Test Method C39/C39M.

15.3 Mix the entire sample of the combined, dry material for concrete either by hand or by machine, except that hand mixing is not applicable to air-entrained concrete. Add mixing water in sufficient amount to produce a slump of 50 mm to 75 mm [2 in. to 3 in.].

15.4 Use a watertight, clean metal container for hand mixing, using either a blunted bricklayer's trowel, hands protected by rubber gloves, or a shovel, whichever is more convenient. Mix the dry batch until the materials appear to be uniformly distributed. Add water while mixing until the concrete is homogeneous in appearance and has the desired slump. If prolonged mixing is required because of the addition of mixing water in increments while adjusting the slump, the batch must be discarded and a new batch made without interrupting the mixing to make trial slump tests.

15.5 Place all materials in the mixer to be used for machine mixing. A mixing period of 3 min followed by a 3-min rest, followed by 2-min final mixing is suggested, unless a different procedure is better adapted to the mixer being used. Cover the open end of the mixer during the rest period to reduce evaporation. Test the slump in accordance with Test Method C143/C143M upon completion of the mixing. If the slump test of the mixed batch shows that additional water is required, return the sample used for the slump test promptly to the mixer, add additional water, and remix the batch for 2 min. Retest the slump. If the slump is not from 50 to 75 mm [2 to 3 in.], discard the batch.

15.6 Discharge the mixed batch into a clean, watertight container that has been predampened, then remix the batch by hand, using a scoop or trowel, until the batch appears to be uniform. Promptly determine the density in kilograms per cubic meter (or pound per cubic foot) in accordance with Test Method C138/C138M. Return samples used for the slump and unit weight test to the container, then remix the batch by hand and mold the specimens.

15.7 Mold six cylinders from each batch, using three cylinders for test at 7 days and three at 28 days, except that in the case of high early strength concrete, three cylinders shall be tested at 3 days and three at 7 days. Compression test specimens shall be cylindrical with a length equal to twice the diameter. The minimum specimen diameter shall be 75 mm [3 in.], but the maximum diameter is not limited, provided the number of specimens for a test as required in this section are molded from a single batch and the sample taken in accordance with 14.1. For acceptance, the average of the strengths of the three specimens tested at each age shall not be less than the compressive strength required in Table 1 for the type of concrete under test and no individual specimen shall have a strength less than 90 % of the required strength.

15.8 The report of the tests of the concrete shall include the following:

³ *Specifications, Tolerances, and Other Technical Requirements of Weighing and Measuring Devices, Handbook 44*, National Bureau of Standards.